

--4--

REMARKS

In the Office Action under reply, the Examiner entered applicants' submission filed on March 20, 2002 and withdrew the finality of the rejections set forth in the Office Action dated October 10, 2001. As a result, the Examiner acknowledged cancellation of claim 29. Thus, claims 1-12, 25, 26, 28 and 30 of this application were examined and stand rejected as follows:

under 35 U.S.C. §112, first paragraph, as drawn to subject matter not described in the specification in such a way as to reasonably convey that the inventor(s) has possession of the claimed invention at the time of filing (claims 1-12, 25, 26, and 28-30);

under 35 U.S.C. §112, second paragraph, as indefinite (claims 1-12, 25, 26, and 28-30);

under 35 U.S.C. §102(b) as anticipated by U.S. Patent No. 5,519,635 to Miyake et al. (claims 1, 3, 25 and 28); and

under 35 U.S.C. §102(e) as anticipated by U.S. Patent No. 5,989,402 to Chow et al. (claims 1, 3, 25, 28 and 30);

under 35 U.S.C. §103(a) as obvious over WO 97/44132 in (Loux et al.) in view of U.S. Patent No. 5,571,410 to Swedberg et al. (claims 1-9, 25, 26, 38 and 30); and

under 35 U.S.C. §103(a) as obvious over Miyake et al. in view of Swedberg et al. (claims 2, 4-9, 26 and 30); and

under 35 U.S.C. §103(a) as obvious over Miyake et al. or Loux et al. in view of Swedberg et al. as applied to claim 26 and further in view of U.S. Patent No. 5,641,400 to Kaltenbach et al. (claims 10-12).

In addition, the Examiner objected to the drawings under 37 C.F.R. §1.83(a).

The aforementioned grounds of rejection are addressed in part by the present amendments and are otherwise traversed for reasons that will be discussed in detail herein. In addition, a proposed drawing revision is submitted herewith. Furthermore, claims 1, 25 and 28 have been amended. Accordingly, claims 1-12, 25, 26, 28 and 30 are now pending.

THE ABOVE CLAIM AMENDMENTS:

Claims 1, 25 and 28 have been amended to clarify that the invention is directed to a modular apparatus for the chemical analysis of an analyte, wherein the apparatus includes a plurality of separation units, each unit is formed from a solid substrate having a microchannel

--5--

present in a surface thereof, each microchannel is of a different length, and *each microchannel forms a separation column or capillary that separates an analyte from a sample according to the molecular characteristics of the analyte*. The claims have also amended to emphasize that reservoir unit can be operatively and modularly connected to each separation unit *in succession*.

Support for these amendments can be found throughout the application as filed. For example, it is disclosed on page 1, line 13, to page 3, line 4, that the invention relates to apparatuses that employ microfluidic planar column or capillary devices to carry out chromatographic separation. Specifically, it is disclosed on page 3, lines 10-13, that an analyte may be driven through a microchannel of the inventive device and that the time in which it takes for the analyte to pass through the microchannel is indicative of the molecular characteristics of the analyte. In addition, it is disclosed that the invention allows for the successive coupling of the separation units with the reservoir unit because, as discussed on page 5, line 22 to page 6, line 7, the modular nature of this apparatus allows for the substitution of different components to accommodate the specific needs associated with analyzing a particular sample. That is, since the apparatus allows for the substitution of a separation unit having a microchannel of a particular length with another separation unit having a microchannel of a different length, it is evident that the separation units of the apparatus may be successively coupled to the reservoir unit. Thus, all pending claims are fully supported by the original disclosure of the application, and no new matter has been added.

OBJECTION TO DRAWINGS:

The Examiner objected to the drawings under 37 C.F.R. §1.83(a) as failing to show every feature of the invention. In support, the Examiner stated that the current figures only show that the reservoir unit 104 is connected to a single chip-shaped separation unit 102, not a plurality of units. In response, applicants point out that 37 C.F.R. §1.81(a) provides that drawings are not required when unnecessary for the understanding of the subject matter sought to be patented. Here, the drawings are not needed for the understanding of the pending claims and are provided only to supplement to the disclosure of the written specification.

In the interest of expediting prosecution, however, applicants have submitted herewith a proposed drawing revision to FIG. 7C, which depicts a reservoir unit with two separation units

Also need reference
to figure 7C in
Brief description
of drawings
detail

NO / only revised
Fig 7C
received

No ref to
102C

--6--

with microchannels of different lengths. Text that accompanies FIG. 7 on page 11, lines 11-17, has been amended to correspond to the revised figure. As discussed above, the application as originally filed discloses the successive coupling of a plurality separation units with a reservoir. Since the revised figure and accompanying amended text merely reiterate subject matter that has already been disclosed in the application as filed, no new matter has been introduced in FIG. 7C or in the accompanying text.

REJECTION UNDER 35 U.S.C. §112, FIRST PARAGRAPH:

Claims 1, 25 and 28 stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter not described in the specification in such a way as to reasonably convey that the inventors had possession of the claimed invention. Specifically, the Examiner stated that the recitation of "a plurality of separation units" and "a single reservoir unit containing a liquid for introducing into *the microchannels of each separation unit*" indicates that the separations units are "*simultaneously* combined with the single reservoir." Furthermore, the Examiner stated that FIGS. 1, 2, 7B and 8 clearly indicate the use of a single separation unit connected to the reservoir unit.

Applicants disagree with the Examiner's contention that the application as filed does not support the invention as claims. As discussed in Applicants' previous response, it is disclosed on page 3, line 22 to page 4, line 2 that "the skilled person may choose a separation unit with a microchannel of a particular length and size for the analysis of a particular sample and choose a separation unit with a microchannel of a different length and sized for a different sample, but choose the same reservoir unit, power unit, hearing unit, etc. for the analysis of both samples." In addition, it is disclosed on page 6, lines 4-6, that components of the invention, e.g., separation units, may be *substituted*. Applicants submit that the term "substituted" when used to describe the use of components indicates that the components may not be used simultaneously. That is, when a first separation unit having a microchannel of a particular length is substituted with a second separation unit having a microchannel of a different length, the separation units are employed *in succession*, not simultaneously.

In the interest of expediting prosecution, however, the applicants have further amended the claims to clarify that the reservoir unit is comprised of a reservoir containing a liquid for

--7--

introduction into the microchannels of separation units *in succession*. As discussed above, this is amply supported in the application as filed. Thus, the pending claims are clearly directed to subject matter that reasonably conveys to one of ordinary skill in the art that the inventors had possession of the claimed invention when the application was filed. Accordingly, the applicants respectfully request reconsideration and withdrawal of the rejection.

Not in
Claim 28

THE REJECTION UNDER 35 U.S.C. §112, SECOND PARAGRAPH:

Claims 1-12, 25, 26 and 28-30 stand rejected under 35 U.S.C. § 112, second paragraph, as indefinite for failing to particularly point out and distinctly claim the subject matter that applicants regard as the invention. Specifically, the Examiner objected to the recitation of a single reservoir unit containing a liquid for introduction into a plurality of separation units in conjunction with recitation relating to the successive coupling of the reservoir unit to each of the separation units. According to the Examiner, this creates confusion and uncertainty with respect to the scope of the claims.

Applicants disagree because it is clear that a single reservoir unit may easily be successively coupled to a plurality of separation units so as to introduce a liquid into each of the separation units. While not wishing to acquiesce in the rejection, but for the sole purpose of expediting prosecution, applicants have nevertheless amended the claims to recite that the reservoir that contains a liquid for introduction into *each of the microchannels of the separation units in succession*. Accordingly, reconsideration and withdrawal of this rejection is respectfully requested as well.

Not in
Claim 28

THE 35 U.S.C. §102(B) REJECTION OVER MIYAKE ET AL.:

Claims 1, 3, 25, 28 and 30 stand rejected as anticipated by Miyake et al. In issuing this rejection, the Examiner contended that Miyake et al. teaches an apparatus for chemical analysis with multiple detachable separation units that may be coupled to a reservoir unit either sequentially or in parallel. In addition, the Examiner stated that this patent discloses a driving unit for supplying or driving liquid from the reservoir unit to a microchannel of each separation unit. In response to applicant's previous arguments, the Examiner pointed to the separation

--8--

device depicted in Figure 6-8 and the accompanying text in column 9, line 65, to column 10, line 18, and stated that these device exhibit different channel lengths for mixing.

Applicants respectfully submit that Miyake et al. does not disclose each and every element of the invention as recited in the pending claims, and therefore cannot anticipate the claimed invention. Turning to the sections cited by the Examiner, it is apparent that the "channels of different lengths" to which the Examiner refers in Figures 6-8 are indicated by reference number 117. According to the text accompanying these figures, channels 117 are "micro mixers." That is, channels 117 serve to mix liquids, not to separate an analyte from a sample. Moreover, applicants submit that the feature shown in Figures 6-8 most akin to the microchannels as recited in applicants' pending claims is chromatocolumn 115. As depicted, these columns have the *same length and shape*. Accordingly, applicants maintain that although Miyake et al. arguably discloses separation microchannels of the same size and shape, separation microchannels of different lengths are not disclosed.

Intended Use
only a channel is claimed

Applicants further emphasize that the invention is directed to a modular microchannel apparatus system for chemical analysis of an analyte that includes a plurality of separation units, wherein *each unit includes a microchannel of a different length* selected according to the analyte. The microchannels serve as miniaturized separation columns or capillaries through which analyte can be driven. Thus, it is clear that the term "channel" as used in Miyake et al. is not synonymously employed in the pending claims. In order to further clarify and to distinguish the inventive subject matter with respect to Miyake et al., however, all claims have been amended to recite that the microchannels in the separation units are of different lengths and *form a separation column or capillary that separates an analyte from a sample according to the molecular characteristics of the analyte*. Because Miyake et al. does not disclose separation units having separation columns or capillaries of different lengths, the patent does not anticipate the pending claims. Accordingly, applicants request reconsideration and withdrawal of the rejection over Miyake et al.

Not structure distinguished due to "channel" or "mixer" from Miyake et al. due to "channel" of the instant invention

THE 35 U.S.C. §102(E) REJECTION OVER CHOW ET AL.:

Claims 1, 3, 25, 28 and 30 also stand rejected as anticipated by Chow et al. In issuing this rejection, the Examiner asserted that Chow et al. teaches a microfluidic separation unit

comprising a replaceable separation unit having a microfluidic channel. Pointing to column 5, lines 3-37, the Examiner also contended that the separation units disclosed in Chow et al. can include at least one micro-scale channel, but that the configuration of the channels can exist in a number of formats. Thus, the Examiner asserted that Chow et al. teaches the use of separation units with different lengths. The Examiner also stated that Chow et al. discloses a system comprising a single reservoir unit having a plurality of reservoirs containing a liquid, as well as an external power unit coupled to a probe that applies a driving force from the reservoir to the microchannel of the separation unit. Additionally, the Examiner stated that a support plate and a membrane or gasket are disclosed.

As discussed above, the pending claims are directed to a modular microchannel apparatus system for chemical analysis of an analyte, wherein the apparatus includes a plurality of separation units, and each unit has a separation microchannel of a different length. Contrary to the Examiner's contention, Chow et al. contains no disclosure relating to a plurality of separation units or microchannels of different lengths. The section cited by the Examiner merely indicates that two or more intersecting microscale channels may be disposed in within a single body structure, and that channel intersections may exist in a number of formats. Applicants submit disclosure setting forth microchannel intersections on a substrate has no relationship to whether microchannels on different substrates have different lengths and whether such microchannels may serve as separation columns or capillaries. Thus, Chow et al. does not anticipate the pending claims, and the applicants respectfully request withdrawal of this rejection as well.

THE 35 U.S.C. §103(A) REJECTION OVER LOUX ET AL. IN VIEW OF SWEDBERG ET AL.:

Claims 1-9, 25, 26, 28 and 30 stand rejected as obvious over Loux et al. in view of Swedberg et al. The Examiner stated that Loux et al. teaches a modular housing assembly for micromachined fluid handling structure that may use a plurality of replaceable separation units. The Examiner also stated that Loux et al. teaches the use of a single reservoir unit with a membrane in conjunction with the separation units, modular heater assembly and power units. Although the Examiner stated that Loux et al. does not disclose a separation device comprising a first and second half, the Examiner stated that Swedberg et al. discloses separation units formed from first and second planar halves with different channels and depths for separation analysis.

--10--

Accordingly, the Examiner maintained that it would have been obvious to combine the teachings of Loux et al. and Swedberg et al. to derive a sample processing compartment featuring enhanced symmetry and axial alignment.

As an initial matter, applicants point out that the Examiner has mischaracterized the functionality of the apparatus described in Loux et al. and that Loux et al. does not disclose micromachined units capable of carrying out separation processes. Instead, Loux et al., as described on page 2, lines 17-22, is generally directed to a fluid-handling apparatus into which a micromachined structure can be inserted. While such an apparatus may be used in conjunction with an instrument for carrying out separation processes (e.g., a gas chromatograph), the apparatus itself is not described as capable of carrying out separation processes. Thus, the micromachined structure described in Loux et al. is only tangentially related to the invention and is not a "separation unit" *per se*. } intended use

In addition, applicants submit that the basic criteria for *prima facie* obviousness have not been met because the Examiner has failed to demonstrate any suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art that Loux et al. and Swedberg et al. should be read together. Instead, it may be inferred from the Examiner's own statements that impermissible hindsight was employed in issuing this rejection. For example, the Examiner stated that Loux et al. does not disclose a separation device comprising first and second halves yet maintained that the motivation to read Loux et al. with Swedberg et al. is "to derive a sample processing compartment featuring enhanced symmetry and axial alignment." Applicants point out that symmetry and axial alignment, as described in Swedberg et al., require the presence of two halves. Without *a priori* knowledge of applicants' invention, one skilled in the art would not have thought to improve the device described in Loux et al. by enhancing symmetry and axial alignment of first and second halves, which, according to the Examiner, are absent from Loux et al. } improper hindsight

In addition, there is no reasonable likelihood of success because Loux et al. and Swedberg et al. describe incompatible technologies. For example, the micromachined body of Loux et al., as described in the paragraph bridging pages 2 and 3, is constructed from a laminate of silicon and/or pyrex. The substrate of Swedberg et al., on the other hand, cannot be silicon or a silicon dioxide material. See column 7, lines 53-56. Thus, it is clear that the microfluidic units

--11--

of Swedberg et al. cannot be substituted for the micromachined units described in Loux et al. Accordingly, reconsideration and withdrawal of the rejection is respectfully requested.

THE 35 U.S.C. §103(A) REJECTION OVER MIYAKE ET AL. IN VIEW OF SWEDBERG ET AL.:

Claims 2, 4-9, 26 and 30 stand rejected as obvious over Miyake et al. in view of Swedberg et al. In support of the rejection, the Examiner employed the same reasoning as that employed in support of the obviousness rejection over Loux et al. and Swedberg et al. That is, the Examiner stated that Miyake et al. does not disclose a separation unit formed from first and second planar halves, wherein at least one of the halves has a channel formed thereon, and that it would have been obvious to combine the teachings of Miyake et al. and Swedberg et al. to derive a sample processing compartment featuring enhanced symmetry and axial alignment.

Applicants submit that the Examiner has again failed to demonstrate that Miyake et al. and Swedberg et al. should be read together. In addition, the analytical units of Miyake et al. appear to be made from silicon substrates (*see* column 1, line 58, to column 2, line 1) using typical semiconductor processing techniques associated with silicon substrates (*see* column 13, lines 22-29), whereas the substrates of Swedberg et al., as discussed above, cannot be silicon or a silicon dioxide material. Accordingly, there is no reasonable likelihood of success, and *prima facie* obviousness has not been established. Since the reasoning behind this rejection is as flawed as the reasoning set forth in the obviousness rejection over Loux et al. and Swedberg et al., this rejection should be withdrawn as well.

THE 35 U.S.C. §103(A) REJECTION OVER MIYAKE ET AL. OR LOUX ET AL. IN VIEW OF SWEDBERG ET AL. AND IN FURTHER VIEW OF KALTENBACH ET AL.:

Claims 10-12 stand rejected as obvious over Miyake et al. or Loux et al. in view of Swedberg et al. as applied to claim 26 and further in view of Kaltenbach et al. The Examiner stated that neither Miyake et al., Loux et al. nor Swedberg et al. teaches a peltier plate operatively and modularly coupled to the support plate for controlling the temperature thereof. However, the Examiner contended that Kaltenbach et al. provides such a teaching and that it would have been obvious to include the peltier plate of Kaltenbach et al in order to influence the physical and chemical parameters involved in separation techniques and decrease the time

--12--

needed to perform separation. As a side note, substantially the same rejection was issued twice in paragraphs 16 and 17 of the Office Action under reply, to which the applicants will address together below.

Applicants submit that the Examiner has again employed the same faulty reasoning as discussed above, since the devices of Kaltenbach et al. do not employ silicon-based substrates. *See* column 5, lines 64-67. In addition, Kaltenbach et al. is no more pertinent to the pending claims than any of the other references cited by the Examiner and that Examiner has again failed to demonstrate that any of these references should be read together and has provided no showing of any reasonable likelihood of success. Accordingly, withdrawal of the rejection is warranted.

CONCLUSION

For all of the above reasons, it is submitted that the application comports with all requirements of 35 U.S.C. §112, and that the pending claims define an invention that is patentable over the art. As the application should now be in condition for allowance, a prompt indication to that effect would be appreciated.

If the Examiner have any questions concerning this communication, she is welcome to contact Michael Beck at (650) 485-3864.

Respectfully submitted,

By:



Louis L. Wu
Registration No. 44,413

Michael J. Beck, Esq.
AGILENT TECHNOLOGIES, INC.
Legal Department, DL429
Intellectual Property Administration
P.O. Box 7599
Loveland, Colorado 80537-0599
F:\Document\5000\0051\amend1.111-5.doc

APPENDIX A
AMENDMENTS TO THE SPECIFICATION

Redactions indicating changes made to the paragraph on page 11, lines 11-17:

Alternatively, as shown in Fig. 7B, the reservoir unit 104B can be made such that the reservoirs (e.g., 106K) have a bottom (e.g., 106L), which is thin so that it can be punctured by a protrusion arm 106M from the separation ~~unit~~units 102B or 102C in succession. The protrusion arms 106M each can have a channel for allowing fluid to flow from the reservoir into the separation unit 102B or 102C. It is preferred that the reservoir unit 104 is made of a material that can seal against the separation unit 102B or 102C well to prevent leakage. As shown, separation units 102B and 102C have channels of different lengths.

APPENDIX B
CLAIM AMENDMENTS

1. (Amended Six Times) A modular microchannel apparatus for the chemical analysis of an analyte in a sample, comprising:

(a) a plurality of separation units each comprised of a solid substrate having a microchannel present in the surface thereof, wherein the microchannel in each separation unit is of a different length and forms a separation column or capillary that separates the analyte from the sample according to the molecular characteristics of the analyte;

(b) a single reservoir unit in the form of a plate comprised of a reservoir that contains a liquid for introduction into each of the microchannels of the separation units in succession; and

(c) an external power source operatively connected to the reservoir unit for driving the liquid from the reservoir through the microchannels of the separation units,

wherein the reservoir unit has dimensions that enable the operative and modular coupling of the reservoir unit to each separation unit in succession to allow liquid from the reservoir to be driven, by the external power source, into the microchannel of the separation unit that is operatively and modularly coupled to the reservoir unit.

25. (Amended Five Times) A kit for making a modular microchannel apparatus for the chemical analysis of an analyte in a sample, comprising:

(a) a plurality of separation units each comprised of a solid substrate having a microchannel present in the surface thereof, wherein the microchannel in each separation unit is of a different length and forms a separation column or capillary separates the analyte from the sample according to the molecular characteristics of the analyte;

(b) a single reservoir unit in the form of a plate comprised of a reservoir that contains a liquid for introduction into each of the microchannels of the separation units in succession; and

(c) an external power source having dimensions that enable its modular and operative connection to the reservoir unit for driving the liquid from the reservoir through the microchannels of the separation units,

wherein the reservoir unit has dimensions that enable the operative and modular coupling of the reservoir unit to each separation unit in succession and to the external power source to

drive liquid from the reservoir into the microchannel of the separation unit that is operatively and modularly coupled to the reservoir unit.

28. (Twice Amended) A modular microdevice for analyte analysis, comprising:

(a) a plurality of separation units each comprised of a solid substrate having a microchannel present in the surface thereof, wherein the microchannel in each separation unit is of a different length and forms a separation column or capillary that separates an analyte from a sample according to the molecular characteristics of the analyte;

(b) a single reservoir unit in the form of a plate comprised of a plurality of reservoirs, wherein each reservoir contains a liquid, each liquid suitable for introduction into a microchannel of a separation unit; and

(c) an external power source operatively connected to the reservoir unit for driving liquids from the reservoir unit through the microchannels of the separation units,

wherein the reservoir unit has dimensions that enable the operative and modular coupling of the reservoir unit to each separation unit in succession to allow liquid from at least one of the plurality of reservoirs to be driven, by the external power source, into the microchannel of the separation unit that is operatively and modularly coupled to the reservoir unit.

APPENDIX C
PENDING CLAIMS UPON ENTRY OF THE AMENDMENT

1. A modular microchannel apparatus for the chemical analysis of an analyte in a sample, comprising:

(a) a plurality of separation units each comprised of a solid substrate having a microchannel present in the surface thereof, wherein the microchannel in each separation unit is of a different length and forms a separation column or capillary that separates the analyte from the sample according to the molecular characteristics of the analyte;

(b) a single reservoir unit in the form of a plate comprised of a reservoir that contains a liquid for introduction into each of the microchannels of the separation units in succession; and

(c) an external power source operatively connected to the reservoir unit for driving the liquid from the reservoir through the microchannels of the separation units,

wherein the reservoir unit has dimensions that enable the operative and modular coupling of the reservoir unit to each separation unit in succession to allow liquid from the reservoir to be driven, by the external power source, into the microchannel of the separation unit that is operatively and modularly coupled to the reservoir unit.

2. An apparatus according to claim 1, wherein at least one of the separation units is chip-shaped and formed from a first half and a second half each having a substantially planar surface facing and joining the other half, wherein at least one of the planar surfaces has a channel thereon such the joining of the two surfaces forms the microchannel.

3. An apparatus according to claim 1, wherein at least one of the separation units has one or more openings leading to the microchannel capable of admitting liquid reagents such that when the separation unit and the reservoir unit are operatively and modularly coupled, the openings are aligned with the reservoirs thereby allowing the liquid reagents and the analyte to pass from the reservoirs into the microchannel without substantial leakage.

4. An apparatus according to claim 2, wherein at least one of the separation units includes a substrate comprised of a material other than silicon or silicon dioxide in which the first microchannel is formed by laser ablation.

5. An apparatus according to claim 2, wherein the reservoir unit includes a membrane that covers at least one of the reservoirs confining the prepackaged liquid reagent therein, wherein the membrane is penetrable with a probe for applying a driving force to drive movement of liquid reagent and analyte from the reservoir through the microchannel of at least one of the separation units.

6. An apparatus according to claim 2, wherein both substantially planar surfaces of the separation unit having a first half and a second half have a laser-ablated channel thereon and the two channels join to form the microchannel.

7. An apparatus according to claim 2, wherein the channel of at least one separation unit is formed by laser ablation.

8. An apparatus according to claim 2, wherein the external power unit comprises a powering plate operatively and modularly coupled to the reservoir unit, the powering plate having an electrical connection to the reservoir to provide a driving force to drive movement of the liquid reagents and analyte from the reservoir through the microchannel.

9. An apparatus according to claim 8, wherein the power plate comprises probes for inserting into at least one of the reservoirs to provide electrical connection thereto.

10. An apparatus according to claim 26, further comprising a peltier plate operatively and modularly coupled to the support plate for controlling the temperature of at least one of the separation units.

11. An apparatus according of claim 10, wherein the peltier plate can be used to heat or cool at least one of the separation units by selecting an appropriate mode of operation.

12. An apparatus according to claim 11, further comprising a heat exchanger operatively connected to the peltier plate to transfer heat between the peltier plate and the surrounding environment.

25. A kit for making a modular microchannel apparatus for the chemical analysis of an analyte in a sample, comprising:

(a) a plurality of separation units each comprised of a solid substrate having a microchannel present in the surface thereof, wherein the microchannel in each separation unit is of a different length and forms a separation column or capillary separates the analyte from the sample according to the molecular characteristics of the analyte;

(b) a single reservoir unit in the form of a plate comprised of a reservoir that contains a liquid for introduction into each of the microchannels of the separation units in succession; and

(c) an external power source having dimensions that enable its modular and operative connection to the reservoir unit for driving the liquid from the reservoir through the microchannels of the separation units,

wherein the reservoir unit has dimensions that enable the operative and modular coupling of the reservoir unit to each separation unit in succession and to the external power source to drive liquid from the reservoir into the microchannel of the separation unit that is operatively and modularly coupled to the reservoir unit.

26. The apparatus according to claim 9, further comprising a support plate for operatively and modularly coupling to the separation units.

28. A modular microdevice for analyte analysis, comprising:

(a) a plurality of separation units each comprised of a solid substrate having a microchannel present in the surface thereof, wherein the microchannel in each separation unit is

of a different length and forms a separation column or capillary that separates an analyte from a sample according to the molecular characteristics of the analyte;

(b) a single reservoir unit in the form of a plate comprised of a plurality of reservoirs, wherein each reservoir contains a liquid, each liquid suitable for introduction into a microchannel of a separation unit; and

(c) an external power source operatively connected to the reservoir unit for driving liquids from the reservoir unit through the microchannels of the separation units,

wherein the reservoir unit has dimensions that enable the operative and modular coupling of the reservoir unit to each separation unit in succession to allow liquid from at least one of the plurality of reservoirs to be driven, by the external power source, into the microchannel of the separation unit that is operatively and modularly coupled to the reservoir unit.

30. The modular microchannel apparatus system of claim 28, wherein each of two separation units of the plurality has a microchannel of a different size.